

Efficient Masked and Unmasked face detection technique using Deep learning algorithm

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Abstract:

Currently, the whole world is passing through a huge pandemic situation which has created a major loss in educational, economic, and many fields. As the first aid or basic precaution, wearing a mask is considered as foremost step according to guidelines. Though wearing masks was not taken as important in the early days, if we go back in the year 2020; from the mid of March, we are facing this pandemic in India. So, if we observe today's world wearing masks has become a mandate. Basically, in this paperwork, we are mainly focusing on protection from Covid-19. So, we have to use different technologies to cover this whole paperwork providing various technologies. Thus, the main objective of this particular paper is recognizing the person has covered his/her face with a mask or non-mask images like using a handkerchief, any pieces of cloth, covering with help of own hands, and so on instances with the help of AI and IoT. Because if you view very minutely in chemical factories, virology laboratories where the instructors or supervisors might be wearing masks taking preventive knowledge but the workers they might not be knowing about all these which will further become a life-risking task for them. So, there should safety line maintained as if someone knowingly or unknowingly crosses the safety line that can be recorded, which will help to guide them furthestmost.

Keywords: Face Mask Detection, Smart City, COVID 19, TensorFlow

Introduction:

The purpose of this paperwork is based on the practice of wearing a proper mask or not after going through the Covid-19. Previously the practice of wearing masks was not so in trend, but recently the practice of wearing masks has reached to peak. According to World Health Organization (WHO), the global rate of infection is discovered around 2.5 million which has resulted in death cases be around 150,000. After such a growth rate of death cases, for the government, the first and foremost priority has become the public health issue. Therefore it is enormously suggested by the World Health Organization (WHO) to assure the people to wear mask who bear such problems related to respiratory organ or those who is building such symptoms. Day-by-day the cases might not reach the peak but who knows if it happens thus in some workplaces they had already declared as wearing a mask is under the rule, if they won't follow it, they might not be allowed from next day onwards or in that moment they might be dismissed from there. So as per situation, with the help of computer and technology, we develop of recognizing the people is wearing a mask or not. This will help to track as well as keep records for

further precautions to avoid transmission. So the project that we are carrying out consists of techniques including Deep Learning (DL), [1] Deep Neural Network (DNN) which boosted the various angles of images in the dataset that we gathered, through the process of progressive learning. As per our knowing, Covid-19 is frequently getting mutated day-by-day which might create a situation of wearing a mask as a regular base habit. So with the advantage of safety, we should also be very aware of the disadvantage. The disadvantage is none other than but the crime rates will rise to the peak. [8] The people might take the wearing of masks as criminal activity by hiding or their facial description. Therefore in the coming days as for our concern, Deep Learning is a continuous process, that's why the way of training should be in such a way so that while detection it must identify the proper mask as well as the correct facial description of that person. It will work as the assistance of identifying the proper mask instead of any other way like a piece of paper or any cloth, handkerchief or by putting the body parts to cover the face. It will absolutely improve it in many ways and further will be termed as an improvised Face-Mask Identification Technique.

Related Work:

The rise in Deep Learning has significantly in the field of Artificial Intelligence. While going through this pandemic situation few practices have been established as BlueDot and HealthMap. BlueDot is a kind method of identifying the unusual pneumonic cluster in Wuhan which ultimately gave this detection as to be pandemic known as Covid-19. As the very first symptom of [2] Covid-19 is recognized as cough, therefore putting a face mask was taken as the initial preventive measure. Initially, people were advised to wear the type of mask that does not allow the droplets of cough and sneezing to come out to avoid the spreading of viruses moving from one to many. Therefore masks that consist of many layers are insisted for usage. Two delegates named Allam and Jones put forward a framework based on the smart city networks during the prevalence of Covid-19, how to manage the data that are being shared for observation. [3] The framework speculates the hope of Urban Health Data concerning the safety management and economy related to the security of nations. [9] In this following process the use of trackers; sensors are being collected from various laboratories. With the blessing of Artificial Intelligence and Deep Learning, it has become highly important in the field of medical science for the treatments of the patients to detect and have the best way to reach out the problems providing medications. [4] Big Data has helped in maintaining the huge dataset of people affected by the coronavirus in day-to-day life where the rate of infected suddenly in rapid altitude. Using this application has helped to monitor the patients with respect to all their past medical history and get to the exact source of the cause. The basic objective of this is to recognize the affected people. The following arrangements of the necessary components and contactless logistic formation of such ways to lower down the spreading of coronavirus in the society.

Dataset:

In order to train our model, we used MobileNetV2 with help of different layers. That's how it learns how to predict unseen faces. Choosing the right images was very crucial as we are using them in the real world with endless possibilities. Our effort was to make it as accurate as possible and it has to be very quick. To edify we gathered images with our best effort and gathered all real-life possible datasets Also we integrated our own images as datasets with various possible face positions to make it real-life ready. Our dataset is divided into 2 parts. The first one with mask contains 567 numbers of images and on the other side without mask contains 559 numbers of images. We used 80% of dataset to train and 20% to test the model. For this project Python Programming Language acts as our backbone. We also took the help of Anaconda and Jupyter Notebook as Platform to train our model and use as run-engine.

TensorFlow, Keras, Sklearn, Imutils, Matplotlib, OpenCV2, Numpy all these packages are used in order to achieve functionalities that structures our Deep Learning Architecture.

Masked and Unmasked using Deep learning architecture:

Time to load MobileNetV2 Network. First we have build Base of the Model for that imagenet: Pre trained model specifically for images those will initialized for us, include_topboolean (Include fully connected layer on top of a network),224, 224, (3 Channels = RGB) are used. Now Head of the model .This will be placed on top of the base model. For Pooling , Flattening and Densing the layers "relu" go to activation function for Non Liner use cases, Dropout: In order to avoid overfitting are used

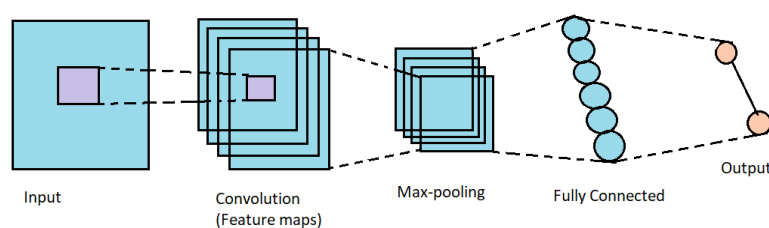


Fig: 1 Convolution Neural Network

Probability based function with 0,1 as Binary so softmax is used. Dense (2) means with & without Mask. Finally Main Model. Now we placed base model underneath the head of the modal.

$$M(T) = (B * H)(a) = \int_{-\infty}^{\infty} B(T) \times (H - a) dT$$

Now loop over all layers in the base of the model and freeze some of them so that they will not be updated in the process of the firsttraining process. [5] Now to compile our model we use Adam optimizer which is the go to optimizer for image prediction is used. Now we have to train the head of the network. Now time to make predictions on the testing set. [10] For each and every image in testing dataset we have to find the index of the label with largest probability. This show a nicely formatted classification report.Now Serialize the model to disk and Plot the training loss and accuracy Matplotlib.

Result Analysis:

We run all training using Google Colab as none of us machine equipped with higher configuration which is required in order to conduct the trails. All packages and modules are already preinstalled, which made the development and implementation process easy and efficient.In our model some images gets true as labeling and our declared them as positive result. On the other side, some get labelled true but prediction model declared it as negative. [6] The opposite pattern also found as some images gets false label also prediction model declared them false. And last pattern gives false labelled data gets true through prediction model. By the result we get a good accuracy and precision. Recall classifies the positive results and F1-score gives the accuracy scale. Overall the result was balanced. [7] The modal showed significant increase in accuracy because of the use of data augmentation. Without any struggle model gives 99% accuracy only after 20 epochs if a person wears a mask or not. Loss was surprisingly low. The following graph proves that.Deep Learning solves [11] the binary classification with the help of

Keras. Evaluation matrices give the accuracy with the help of Region of interest pooling curve, classification and by comparison. This plot gets its shape by using Matplotlib.

Fig 2: Training accuracy curve

This classification table shows and explains precision, recall, f1-score level and accuracy of the overall modal. Now time to real world testing. These are some images on which predictions are made by our model using MobileNetV2. The green rectangle box represents the right way that one should wear a mask with the accuracy level on the Left-top corner. On the other side red box represents different incorrect ways that person wears a mask.

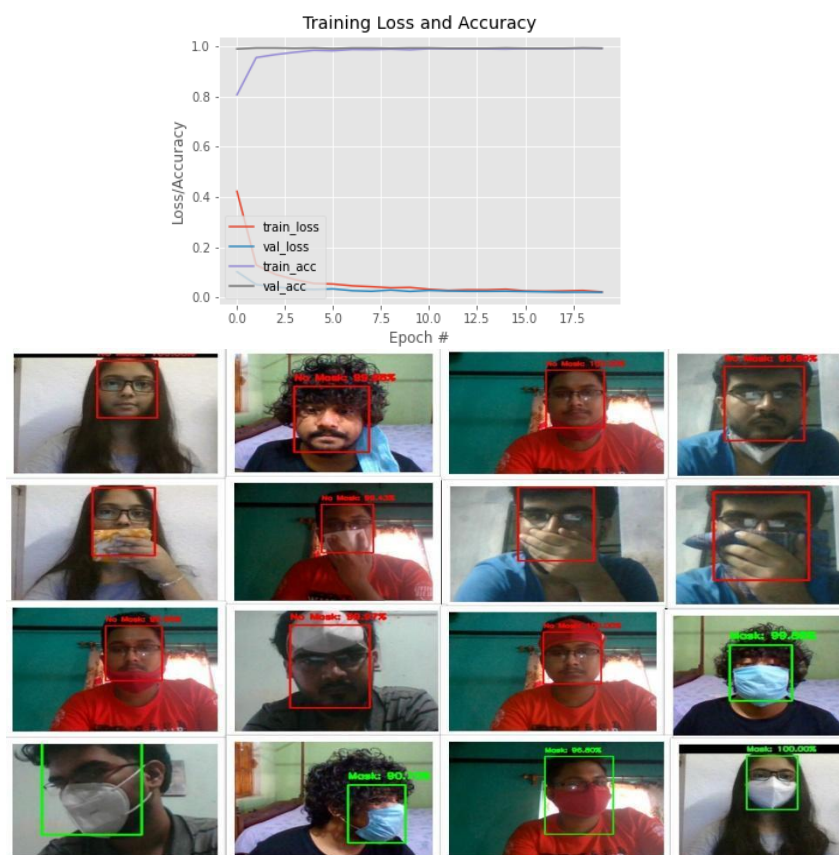


Fig 3: Testing Examples

Conclusion:

Coming to the conclusion section we utmost wanted to prepare the paper work with the advantage of identifying the people without mask and the people with mask as per the application of video streaming. These will obviously be very effective for the administrative level department to keep an eye over the rise in daily to daily cases. Here in this project we have imported various modules like Tensorflow, OpenCV, Keras, Imutils, Numpy, MobileNet, Matplotlib with the support of Python 3 and text editors. We have a very minimum amount of dataset which has to raise various difficulties to perform the training process for getting the proper accuracy of the detection method. The dataset that we have collected all basically from our own team members and requested the people we know to come forward

and contribute the pictures with masks and without masks to carry out the sample test cases. This identification method needs various angles and views of faces wearing masks or not. This is done because many among all does not even properly inform about the correct way of putting the mask in their face covering mouth and face essentially. [12] Even it has been noticed that some of the peoples do not cover their nose while wearing a mask and they keep their mask below their mouth, on their neck and ears. So focusing on these circumstances this detection method is highly preferred. MobileNetV2 is being used as it occupies fewer parameters and is faster in comparison to convolution. And we will further wish to touch the ladder of achievement by providing much data so that it will help in maintaining the accuracy rate with progressive learning of further datasets. The actual reason for increasing the popularity is to decrease the rate of affected and to reduce the scale of deaths. It will be the preventive method to bring back the life we used to lead before the entry of Covid-19 into our life.

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